B1 cont'd.

predetermined position during relative tangential motion between the brush and its substrate (i.e., commonly a slip ring or commutator), (ii) to apply a predetermined, approximately constant (compare the data in Table III) mechanical pressure between the brush running surface and the substrate while the brush may wear, and (iii) to conduct electrical current to or from the brush.

Page 1, line 22 to page 2, line 11, please amend the paragraph to read as follows:

The electrical brushes at issue include all conventional "monolithic" brushes (i.e. made in one piece of graphite or graphite-metal mixtures), but are principally metal fiber brushes disclosed in U.S. Patent Nos. 4,358,699 and 4,415,635, and in the co-pending international patent application Serial No. 09/147,100 and foil brushes as described in the publication "Production and Performance of Metal Foil Brushes," P.B. Haney, D. Kuhlmann-Wilsdorf and H. G. F. Wilsdorf, WEAR, 73 (1981), pp. 261-282. The present invention is particularly useful for electrical metal fiber brushes in motors and generators when operating at high current densities, especially in homopolar motors/generators. The present invention includes the use of various technologies referenced and described in the above-noted U.S. Patents and Applications, as well as described in the references identified in the appended LIST OF REFERENCES and cross-referenced throughout the specification by reference to the corresponding number, in brackets, of the respective references listed in the LIST OF REFERENCES, the entire contents of which, including the related patents and applications listed above and the references listed in the LIST OF REFERENCES, are incorporated herein by reference.

Page 3, line 18 to page 4, line 11, please amend the paragraph to read as follows:

B2 cont.

In previous inventions, particularly in the Patent Application "Continuous Metal Fiber Brushes, [1]" the capabilities of metal fiber brushes, including multitudes of essentially

B2 concl'd.

parallel hair-fine metal fibers, are outlined. Metal fiber brushes are intrinsically capable of easily conducting the desired current densities and to do so up to at least 70 m/sec with a total loss in the order of 0.1 Volt per brush. At the same time such brushes are electrically very quiet. These superior qualities derive from large numbers of separate electric "contact spots," namely at the fiber ends at the brush "working surface" sliding along the brush-substrate interface, through which the current is physically conducted on a microscopic scale. That the current is conducted across solid interfaces only through a restricted number of contact spots, whose total area amounts to only fractions of one percent of the macroscopic area of contact, is a well-known general physical phenomenon. To a large extent the poor qualities of monolithic brushes arise from their small number of contact spots, namely in the order of ten per brush. As a result, the current flow lines in monolithic brushes are not rather uniformly distributed, as they are in metal fiber brushes, but they are "constricted" [2] at the few contact spots. This causes the corresponding "constriction resistance" that represents in the order of one third the resistance of monolithic brushes. This constriction resistance is eliminated in metal fiber brushes on account of their large number of contact spots.

Page 5, line 17 to page 6, line 2, please amend the paragraph to read as follows:

B3 cont.

As stressed, on account of their different geometry, foil brushes include a substantially smaller density of contact spots than well-constructed metal fiber brushes. By numerical example, the working surface of a typical metal fiber brush constructed of d = 50μm copper wires of about f =15% packing fraction contains roughly 10,000 contact spots per cm^2, namely, one at each of the individually flexible fiber ends. In a foil brush with d_f = 25μm thick parallel foils and f = 50% packing fraction, there are about 600 contact spots per cm^2, located at the foil edges sliding on the substrate, with an estimated three contact spots

B3 concl'd

per foil edge. Correspondingly, without suitable modifications of the substrate, foil brushes will be very superior to monolithic brushes, but fall short of metal fiber brushes [4].

Page 6, lines 8-10, please amend the paragraph to read as follows:

B4

• lower mechanical pressure, namely several pounds per square inch for monolithic brushes, versus about 1 Newton per square centimeter $\simeq$ 1 pound per square inch for fiber brushes.

Page 7, after the paragraph at lines 20-21, please insert the following paragraph:

B5 cont.

Yet another object of the present invention is to provide a novel brush holder that can be used for a sequence of an indefinite number of brushes.

Page 8, lines 1-3, please amend the paragraph to read as follows:

Still another object of the present invention is to provide a novel brush holder, which provides a light approximately constant pressure to a fiber or foil brush sliding against a substrate for extended periods of time.

Page 8, lines 4-6, please amend the paragraph to read as follows:

Another object of the present invention is to provide a novel brush holder and ancillary cables, which has low electrical resistance to improve the current densities generated by the fiber or foil brush sliding against the substrate.

Page 8, lines 7-14, please amend the paragraph to read as follows:

To achieve this and other objects, the present invention provides a novel electrical brush holder for applying a mechanical force to an electrical brush and for establishing electrical contact between the electrical brush and a current conducting element. The brush holder includes a first wall (herein also called "top wall") fastened to the current conducting element, a second wall (herein also called "bottom wall") that is releasably fastened to the brush via its base plate, and a sidewall lengthwise extendable in an axis direction of the

B5 cont'd.

brush. The sidewall cooperates with the first and second walls to form a volume defined by the first wall, the second wall and the sidewall. A fluidic medium is contained in the volume for applying a light approximately constant pressure to the brush. The present invention further provides a novel cable for conducting current at low resistance and low mechanical force between the current conducting element and the base plate of the brush.

Page 9, lines 1-3, please amend the paragraph to read as follows:

B6

Figures 2A to 2C are schematic cross-sectional views of the brush holder according to the present invention with one brush (Figure 2A) and two brushes (Figure 2B) attached to one second (i.e. bottom) plate, and with two brushes attached to two second (i.e. bottom) plates (Figure 2C);

Page 9, lines 16-17, please amend the paragraph to read as follows:

B7

Figures 6A and 6B are cross-sectional views of brush holders including wedge-shaped first and second walls (i.e. at top and bottom, respectively) to facilitate orienting the brush relative to the substrate;

Page 9, lines 20-22, please amend the paragraph to read as follows:

B8

Figures 8A to 8C are cross-sectional views of different brush holders in which the current is conducted through what essentially are liquid metal cables and the brush force is supplied by mechanical springs;

Page 10, lines 1-3, please amend the paragraph to read as follows:

Figures 9A to 9C are cross-sectional views of brush holders in which the current is conducted through a highly flexible cable of metal fibers and the brush force is supplied by compressed gas.

Page 10, line 11 to page 11, line 5, please amend the paragraph to read as follows:

B9

In future high-performance applications of metal fiber brushes, it is envisaged that currents of up to 2000 Amperes will be conducted through brushes of up to 1 square inch of working surface (e.g., a brush foot print on a slip ring), while the brush is pressed against the substrate (i.e., in this case a slip ring, with a brush pressure in the range of 1 Newton per square centimeter, i.e., roughly one pound per square inch). The brush pressure is intended to be maintained approximately constant, i.e. within a factor of two or three, even while the brush may slide at a high speed, up to more than 100 mph, and in course of time may shorten in length through wear by up to about one inch. Further, uncontrolled lateral motions of the brush other than its intended sliding, and in particular rotations of the brush axis during use are detrimental to brush wear. Therefore, such motions must be constrained within narrow limits. Finally, and most importantly, for high-performance applications, the sum of the friction loss and joule heat of the brush and its holder and current leads together, should not exceed 0.25 watt per ampere conducted, i.e. 0.25 Volt. These demanding conditions can be achieved with metal fiber or foil brushes, but not with currently available brush holders, at least not at "normal" (i.e., well above cryogenic or super-conducting) temperatures as prevail in almost all machinery. This is because ordinary cables of sufficient cross section to conduct the high currents at the required low losses are so stiff that they significantly if not disastrously interfere with the required uniform small brush forces that must be maintained over long periods of time even while the brushes shorten through wear.

Page 11, lines 13-23, please amend the paragraph to read as follows:

B10 cont.

Specifically, the spring force, F_L of a uniform cantilever of width w, length L and thickness t, made of a material with Young's modulus E, and the elastic deflection Δl of its free end is

$$F_L = (Ewt^3/4L^3)\Delta l \qquad (1).$$

B10 concl'd.

The same equation, except with the factor ¼ being replaced by 4, holds for the deflection of the center of a doubly supported flat spring. However, since such springs involve two sliding contacts to the current supply, and since these will have an unknown, erratic resistance besides being prone to stick-slip, doubly supported flat springs are unlikely candidates for actual current conducting loading devices for electrical brushes. Lastly, for a spiral spring of N_H turns of diameter D, made of wire with diameter d, it is, with the shear modulus $G \approx 0.4E$,

$$F_H = (Gd^4/8N_H D^3)\,\Delta l \qquad (2).$$

Page 17, lines 3-11, please amend the paragraph to read as follows:

B11

The data in Table II indicates that at sufficiently fine fiber diameters, electrical cables of standard types of construction can be made flexible enough for leading current to and from metal fiber brushes at ambient temperatures even under the most demanding circumstances. However, in order to keep the friction forces among the individual strands low, the packing fraction of the solid material in the cables should be small, e.g. 1/3rd, so the contemplated $A_C = 0.1\text{cm}^2$ cables would have a macroscopic diameter of about 0.3cm^2, i.e. about 5mm diameter. This would seem still feasible for cabling to a 1cm^2 brush but will approach the practical limit. A further advantage of such cabling will be the opportunity to fit electrical connectors to its ends, or to branch or even fit it with electrical outlets.

Page 18, lines 2-17, please amend the paragraph to read as follows:

B12 cont.

The desired electrical cabling for conducting current to and from brushes at very low electrical resistance and transmitting low mechanical forces can also be constructed of liquid metal confined in flexible tubing (e.g. such as connecting shower heads to a water supply), or perhaps more simply in flexible plastic tubing. Such cabling will have the same advantage as solid metal cabling constructed of ultra-fine fibers, namely that it can be readily branched or fitted with connectors and current outlets. Albeit, for the same electrical resistance per

B12 cncl'd.

length of cable, the conducting material cross-section must be proportional to the ratio of the resistivities concerned, i.e., for a liquid metal with a ten times larger electrical resistivity (which is a reasonable or perhaps conservative estimate), the cross-section of the conducting area must be ten times larger than for the solid metal. Accordingly, since in the order of only 1/3rd of the solid metal cabling will typically be occupied by the fibers, the actual cross-section of the liquid metal cable exclusive of its tubing would be 10/3 that of the solid cable, and the cable radius $(10/3)^{1/2} = 1.8$ times larger than for the solid cable. Accordingly, liquid metal cabling will typically be fairly massive in size. Such liquid metal cabling can be even more easily fitted with electrical connectors and can be made to branch or to be fitted with electrical "plugs" than solid cabling made of ultra-fine fibers.

Page 19, lines 1-3, please amend the paragraph to read as follows:

B13

2. As the brush wears, it must apply an approximately constant force to maintain an approximately constant pressure between the brush face and the substrate even while the brush may wear through significant lengths.

Page 21, lines 1-9, please amend the paragraph to read as follows:

B14

In Table III, p_B has been calculated for $A = A_B$, $h_o = 0.4$cm, $p_B = \beta\ 3$ [N/cm^2] (where, β is the brush pressure in units the maximum pressure at which the average contact spot is still elastic, see [7]), $m = 0.3$ and $p_{Go} = 3.64$ [N/cm^2]. In order to keep the brush pressure within reasonable limits, however, β must remain within the limits of 0.7 and 0.25. TABLE III indicates the dependence of brush pressure on wear length by the use of a brush holder of initial height h of 0.6cm partly filled with liquid metal and partly with gas at the indicated pressures. At h = 0.4 cm, the metal would occupy m=30% of the interior holder volume. A total wear length of 9mm is possible between $\beta = 0.7$ and 0.25. Below $\beta = 0.25$ arcing is likely.

Page 22, lines 1-5, please amend the paragraph to read as follows:

B15

One difficulty with the above design would be a relatively high electrical resistance since the liquid metal cross section through which the current must flow, is on average only about 10% of the brush area but it is also only about 1cm long. The advantage of this design is that it is self-contained and maintenance free, could be made cheaply, and could form an integral part of brushes to be discarded with them at the end of their life.

Page 22, lines 6-10, please amend the paragraph to read as follows:

Alternatively, the liquid metal could be replaced by a cable made of ultra-thin fibers in accordance with section (b) discussed previously. If self-contained, the pressure would drop a little slower than in the table above, and if the gas is connected to a compressed gas reservoir, the brush force would remain constant. In the first case the obtainable wear length would be mildly increased, and in the second case it would be almost indefinite.

Page 22, lines 13-16, please amend the paragraph to read as follows:

B16

(i) In the means by which the brush holder, at its first (i.e top) wall, is connected to the current-conducting element, among others through screws, by soldering, a dove tail, a bayonet closure, cementing or gluing (in case the electrical connection to the base plate of the brush is made through cabling);

Page 22, lines 17-18, please amend the paragraph to read as follows:

(ii) Whether or not the gas is wholly confined within the brush holder cavity or is pressurized from an exterior reservoir;

Page 22, lines 19-20, please amend the paragraph to read as follows:

(iii) In the means by which the brush is fastened via its base wall, to the second (i.e. bottom) plate of the brush holder, among others by the same means as in (i);

Page 23, lines 4-9, please amend the paragraph to read as follows:

(vi) In the means for providing restraints to minimize uncontrolled brush movements other than its sliding relative to the substrate and its advance in the course of brush wear, among others though rigid prismatic tubing within which the second wall or the brush base plate is guided, or through rods that are parallel to the brush axis direction and one end of which is fixed to the first (i.e. top) wall and to the second (i.e. bottom) wall or the brush base plate, respectively;

B17

Page 23, lines 11-13, please amend the paragraph to read as follows:

B18

(viii) In the shape of the first and/or second walls, e.g. angled in conformity with the intended brush orientation relative to the current-conducting element, e.g., the stator, and the substrate;

Page 23, after the paragraph ending at line 15, please insert the following paragraph:

B19

(x) Whether and in which manner the electrical conduction between the current conducting element and the base plate of the brush is supplemented by electrical cabling.

Page 23, line 18 to page 24, line 2, please amend the paragraph to read as follows:

Turning now to the drawings, wherein like reference labels designate identical or corresponding parts throughout the several views, Figure 1A is a schematic cross-sectional view, including a variety of useful optional features, of the brush holder 100 disclosed in co-pending International Application SN 09/147,100. The brush pressure is applied and the current is fed from the brush 4 by a liquid metal 8 in communion with a pressurized liquid metal reservoir (not shown), so that the liquid metal 8 is used for both brush force application and a low-resistance current path. Valves 50(1), 50(2) and 50(3) permit adjustments of the fluid pressure and mechanical linkage 51 permits positioning of the brush holder.

✓Page 24, lines 3-16, please delete the paragraph in its entirety.

Page 24, line 17 to page 25, line 11, please replace the paragraph with the following paragraphs:

B20 Cont.

Figures 2A to 2C are schematic cross-sectional views of the brush holder according to the present invention with one brush 4 in Figure 2A, and with two brushes 4(1) and 4(2) in Figures 2B and 2C. The brush base plates 5, 5(1) and 5(2) are releasably attached (25, 25(1) and 25(2)) to a single second (i.e. bottom) wall 3 in Figures 2A and 2B, and to two independent second walls 3(1) and 3(2) in Figure 2C. Brushes 4, 4(1) and 4(2) slide on substrates 7, 7(1) and 7(2), respectively. Figure 2A also includes a flexible cable 28 made of ultra-fine metal fibers to provide a low-resistance current path between the current conducting element 6 and the base plate of the brush 5.

In more detail, Figure 2A depicts the brush 4 pressed against a substrate 7 (typically a slip ring or a commutator) in an axis direction 13 of the electrical brush by means of a compressed gas 10 confined between a first wall 1, a second wall 3 and a side wall 2 that is extendable in brush axis direction 13. The bottom wall 3 is releasably attached to the brush 4 via conductive releasable fastening mechanism 25. The top wall 1 is connected to current conducting element 6 via an electrically conductive fastener mechanism 24. The fastening mechanism 24 may be any fastener or combination of fasteners that permits a current to pass and secures the conducting element 6 to the first wall 1, such as screws, solder bayonet closure, dove tail, etc. optionally supplemented by cement, glue, etc. The fastening mechanism 24 should be strong enough to keep the conducting element secured to the first wall 1 during lengthy periods of operation, etc. Current which is conducted through brush 4 sliding against substrate 7 reaches the current conducting element 6 via brush base plate 5, electrically conductive releasable fastener mechanism 25, second plate 3, cable 28 and first wall 1.

B20 cont.

For clarity, Figure 2B does not show the electrical cable that will be needed if, as indicated, again the brush pressure is applied through compressed gas 10. Depending on demands on total electrical resistance between the conducting element 6 and substrates 7(1) and 7(2) such a cable may not be needed if compressed liquid metal is used instead. Most importantly, Figure 2B differs from Figure 2A in illustrating the use of two brushes 4(1) and 4(2) sliding on two different substrates 7(1) and 7(2), which in this case are shown as moving in opposite directions but could move in any arbitrary relative orientation. Also shown in Figure 2B are the two brush base plates 5(1) and 5(2) for each of the brushes 4(1) and 4(2) that are attached to the bottom wall 3 via releasable, conductive fastening mechanisms 25(1) and 25(2). Those latter mechanisms are similar to fastening mechanism 24 and can comprise any fastener or combination of fasteners sufficiently strong to reliably secure the brush base plates 5(1) and 5(2) to the second wall 3 such that current can readily flow between the base plates and second plates. As in Figure 2A, the side wall in Figure 2B is compressible in the direction of the brush axes 13 such as bellows. Since this implies low rigidity normal to axis direction 13, Figure 2B also includes a rigid tubing 26 to restrict the movements of the side wall 2, and thus restrict unwanted lateral movements of the brushes 4(1) and 4(2). Also shown are guides 27 between the bottom wall 3 and the rigid tubing 26 to guide the brushes 4(1) and 4(2). That is, the guides 27 prevent the brush holder from moving around within the rigid tubing 26 so as to prevent unwanted lateral movements of the brushes, and thus guide the brushes 4 downwards as they wear. Also shown in Figure 2B is a flexible hose 14 for pressurizing a gas 10 from outside of the brush holder. That is, using the flexible hose 14, the pressure of the gas 10 within the side wall 2 and first wall 1 and second wall 3, may be increased or decreased independent of brush wear and thus can maintain constant force. As

B2 cont.

already indicated, the brush pressure is in an axis direction 13 of the electrical brushes 4(1) and 4(2).

Page 25, lines 12-23, please amend the paragraph to read as follows:

Figure 2C also illustrates a brush holder for holding two brushes 4(1) and 4(2) respectively against substrates 7(1) and 7(2). In this figure, there are two second (i.e. bottom) walls 3(1) and 3(2) for the brushes 4(1) and 4(2). This is different than Figure 2B, in which there is only one bottom plate 3. The brushes 4(1) and 4(2) are pressed against the substrates 7(1) and 7(2) along their respective brush axes 13(1) and 13(2) via a compressed fluid 9 that could be a liquid metal, a some gas, and again a cable or other current conducting means (not shown) would have to be used in case the compressed fluid 9 in Figure 2C were non-conducting. Also shown is a telescoping side wall 16, which is sealed against fluid leakage and lengthens or shortens depending on the brush wear. In addition, by electrically disconnecting the holder from the current-conducting element (6), the arrangements in both Figures 2B and 2C may be adapted to lead a current between the two different substrates 7(1) and 7(2), instead of between the current-conducting element 6 and the two substrates.

Page 26, lines 1-6, please amend the paragraph to read as follows:

Figures 3A to 3C show examples of different arrangements in which the brush pressure may be applied by a liquid metal in pressure-transmitting contact with a compressed gas via flexible membranes 11. In Figure 3A, the pressurized gas 10 is confined in small spherical volumes like little balloons (i.e., flexible membranes 11) that are surrounded by a liquid metal 9. The first wall 1, side walls 2 and second wall 3 confine the flexible membranes 11 and liquid metal 8.

Page 26, lines 7-10, please amend the paragraph to read as follows:

B20 cont.

Figure 3B illustrates a toroidal flexible membrane 12, much like an inner tube of a car tire, filled with a compressed gas 10. The liquid metal 8 surrounds and occupies a portion in the center of the configuration (i.e., in the middle of the membrane 12). The toroidal flexible membrane 12 is secured between the top wall 1 and bottom wall 2 at attachment areas 20.

Page 26, lines 11-15, please amend the paragraph to read as follows:

Figure 3C illustrates the flexible membrane 11 with the compressed gas 10 surrounded by the liquid metal 8 (rather than the compressed gas 10 surrounding the liquid metal 8 as in Figure 3B). The liquid metal 8 and flexible membrane 11 (with the compressed gas 10) is contained via the top wall 1, bottom wall 3 and spiral side walls 19. The spiral side walls 19 are composed of spiral tubing, such as that for a clothes dryer's exhaust.

Page 26, lines 16-23, please amend the paragraph to read as follows:

Comparing Figure 3D with Figure 3B illustrates the possibility that the compressed gas 10 may be pressurized from an outside via a flexible hose 14 as in Figure 2B. That is, as shown in Figure 3D, the pressure of the gas 10 may be controlled via the flexible hose 14 connected to an external reservoir. Thus, it is possible to maintain a constant brush force via the flexible hose 14. On the contrary, if the gas is entirely confined within the inner volume of the brush holder defined by the first wall 1, second wall 3 and side walls 2, 19 as in Figures 3A, 3B and 3C, the pressure and hence the brush force, drops as the brush wears and the indicated inner volume of the brush holder increases.

Page 27, lines 1-7, please amend the paragraph to read as follows:

Each of the side walls shown in the above figures are lengthwise extendable in the brush axis direction 13 and should be configured to prevent uncontrolled lateral brush motions that are detrimental to the performance of the brush. For example, depending on particular conditions, the toroidal flexible membrane 12 in Figure 3B and 3D and the spiral

B20 cont.

tubing 19 in Figure 3C should be laterally adequately stiff to prevent erratic lateral brush movements. It is also possible to further constrain erratic lateral brush movements by using the telescoping tubing shown in Figures 4A-4B (and Figure 2C).

Page 27, lines 8-14, please amend the paragraph to read as follows:

For example, as shown in Figure 4A, the toroidal flexible membrane 12 having the compressed gas 10 therein is constrained from expanding outwards via the telescoping side wall 16. The telescoping side wall 16 provides sufficient support for the toroidal flexible membrane 12 so as to prevent erratic lateral brush movements. Figure 4B is similar to Figure 4A, but shows the telescoping side wall after the brush 4 has worn. As shown, the telescoping side wall 16 naturally slides downwards in the direction of the brush axis 13 as the brush wears.

Page 27, lines 15-22, please amend the paragraph to read as follows:

Figure 5 illustrates another embodiment in which a flexible side wall 15 made of thin plastic or rubber/elastomer sheet may be contained via rods 21 supporting the flexible side wall 15. The flexible side wall 15 may be in addition to the flexible membranes 11 and 12 or may itself contain the compressed gas 10 and/or liquid metal 8. The flexible membrane 15 is supported by the rods 21, which are attached to the top wall 1 and bottom wall 3. Thus, with this configuration, erratic lateral brush movements may be prevented. The brush rods 21 are also in the brush axis direction 13 and may be made of TEFLON, for example, for ease of sliding during brush wear.

Page 28, lines 1-6, please amend the paragraph to read as follows:

Figures 6A and 6B show the use of wedge-shaped first and second walls, singly or in combination, to angle the brush 4 relative to substrate 7 as desired. For example, as shown in Figure 6A, a wedge-shape bottom plate 23 may be releasably attached to the brush 4 to angle

B20 cont.

the brush 4 relative to the substrate 7. Figure 6A includes the flexible membrane 11 similar to that shown in Figure 3A, but also includes a side wall 17 in the form of bellows to inhibit erratic lateral brush movements as discussed previously.

Page 28, lines 7-16, please amend the paragraph to read as follows:

Figure 6B is similar to Figure 6A, but includes an additional wedge-shaped top wall 22. Figure 6B also illustrates another possible configuration of the compressed gas 10, the flexible membrane 11 and the liquid metal 8. Further, the flexible membrane 11, gas 10 and liquid metal 8 may be contained via side walls 19 composed of spiral tubing and the rigid tubing 26 so as to apply pressure to the brush 4 in an axis direction thereof. Further, it is possible that a connection to an exterior gas pressure reservoir is also included in Figure 6B (similar to that shown in Figure 3D) to maintain a constant brush force. The guides 27 in Figure 6A, just as the guides in Figure 2B may be used to guide the wedge-shaped bottom plate 23 between the rigid tubing 26 so that the brush is pressed towards the substrate 7 in a longitudinal axis direction and to inhibit erratic lateral brush movements.

Page 28, line 17 to page 29, line 5, please amend the paragraph to read as follows:

Figures 7A-7C are perspective views of liquid metal cables made of flexible and extendable tubing filled with liquid metal and fitted with different electrical connectors. For example, Figure 7A illustrates a liquid metal cable 40 having a sidewall 18 composed of flexible tubing capped off with an electrical connector 30A. The electrical connector 30A may be a simple metal terminal which can be welded or soldered, for example, to another object (e.g., electrical device). Thus, the liquid metal cable 40 may be used to connect the first wall 1 to the second wall 3 in brush holders. This feature is discussed in more detail with reference Figures 8A-8C. Figure 7B illustrates a liquid metal cable 42 having a side wall 19 composed of spiral tubing and having electrical connectors 30B and 30C. The

B20 cont.

electrical connectors 30B and 30C may be conventional "plug" electrical connectors. Figure 7C is another embodiment of a liquid metal cable 44 which includes a flexible tubing 29 containing the liquid metal 8 and having electrical connectors 30D and 30E.

Page 29, lines 6-15, please amend the paragraph to read as follows:

Turning now to Figures 8A-8C. Figures 8A-8C show different brush holders in which the current is conducted through liquid metal much as in liquid metal cables and the brush force is applied by mechanical springs. For example, in Figures 8A and 8B, that part of the brush holder (alternatively to be viewed as a liquid metal cable 46) is easily extendable by means of a highly extendable side wall 2 and contains a helical spring 31 which applies a mechanical force between the first wall 1 and second wall 3. The second plate with its releasably attached brush (not shown) is guided in the brush axis 13 direction by the telescoping side wall 16 while the spring 31 provides the brush force. In an initial state, the spring 31 is strongly compressed and the side wall 2 has a large average diameter (see Figure 8A). At its fullest final extension, the side wall is held in place where it is fastened to the first wall 1 and second wall 3, but is mainly constrained by the helical spring 31 (See Figure 8B).

Page 29, lines 16-22, please amend the paragraph to read as follows:

Figure 8C illustrates another example of combining the concept of liquid metal cables and mechanical springs for making electrical brush holders. As shown in Figure 8C, the spring 31 provides the brush force and is of a leaf design and is wholly outside the liquid metal 8 contained within the side walls 15. Further, part of the brush holder that resembles a liquid metal cable 47, accommodates a distance increase between the first wall 1 and the second wall 3 in the course of brush wear not through elongation as in Figures 8A and 8B, but by straightening out from a bent position.

B20 concl'd.

Page 30, lines 1-11, please replace the paragraph with the following paragraphs:

Figure 9A shows a brush holder in which the pressurized fluid is a gas 10 that is entirely contained within an inner volume of the brush holder defined by the first plate 1, the second plate 3, and flexible side walls 15. A current between the top plate 1 and the brush 4 is conducted through a highly flexible cable 28 made of ultra-fine metal fibers within that same inner volume of the brush holder. Also shown are a rigid tube 26 and guides 27, to guide in axis direction 23, the wedge-shaped bottom plate 23 and thereby brush 4 as it wears. Figure 9B is similar to 9A, but has a flat second wall 3. Further, Figure 9B includes telescoping side wall 16 and flexible hose 14 to maintain a constant pressure of the gas 10. The flexible hose 14 may be connected to an exterior gas reservoir as previously discussed.

Figure 9C is otherwise the same as Figure 9B but the flexible cable 28 is outside of the inner volume of the brush holder defined by the first plate 1, the second plate 3 and the flexible side wall 15. Similarly, a flexible cable 28 may be used to establish a low-resistance current path between conducting element 6 and brush 4 for any embodiments of the invention. Flexible cable 28 may be similarly applied to any brush holder independent of construction.

IN THE CLAIMS

The following is a clean copy of amended Claims 1, 7, 21 and 27 with a marked-up copy attached:

B21

Sub C2

1. (Amended) An electrical brush holder for applying a mechanical force to an electrical fiber or foil brush and for establishing electrical contact between the electrical brush sliding against a substrate, and a current conducting element, comprising:

a first wall fastened to the current conducting element;